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KENYON & KENYON
333 W. San Carlos Street, Suite 600
San Jose, CA 95110-2711

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SAXENA, AKASH	
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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

MAILED

APR 16 2007

Technology Center 2100

Application Number: 09/982,061
Filing Date: October 17, 2001
Appellant(s): MONROE, ERIC M.

Michael P. Paul
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 31st October 2006 appealing from the Office action mailed 14th October 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

- Nicholas P. Mencinger , Intel Technology Journal Q3, 2000, Pgs.1-8
- Matt Doty, Application Specific Semiconductor Device Qualification Methodology (Paper & presentation) (December 1999) Pgs.1-20 (Paper), Pgs.1-12(Presentation)
- ReliaSoft's ALTA 1.0 On Site Training Guide 1999 by ReliaSoft Corporation (ALTA 1.0 Hereafter) Pgs.1-60
- Ted Dellin et al, Semiconductor device reliability Failure Models, 2000, Sematech International, Pgs.1-27

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. **Claims 1-5 & 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Intel Technology Journal Q3, 2000" by Nicholas P. Mencinger et al (Mencinger hereafter) in view of "Application Specific Semiconductor Device Qualification Methodology (Paper & presentation)" by Matt Doty (December 1999) (Doty hereafter).**

Regarding Claim 1

Mencinger teaches

> "A method of quantifying the reliability test requirements of a package/chip device over a product lifetime comprising:
> modeling different types of ambient and power-driven temperature cycle fluctuations the package/device is expected to undergo over the product lifetime;"

as a methodology to model failure and reliability (Mencinger: Page 2, Col.1, Lines 5-7) for various failure mechanisms for chips and packages (Mencinger: Page 2, Col.1, Lines 17-19) over a product life time for various temperature and power cycle fluctuations (Mencinger: Page 2, Col.1, Lines 35-38, 49-51; Table 1).

Mencinger also teaches:

> "and determining the ***accelerated life test requirements*** that represent ***each*** of the different types of temperature cycles fluctuations."

as determining accelerated life tests requirements (Mencinger: Page 4, Table 2 – where each row of table having temperature dependent environmental variation can represents different types of temperature cycle). Further, Mencinger teaches the Coffin-Manson empirical model as an example which although is not claimed by the application but used in specification.

Mencinger does not disclose accelerated life tests requirements for other situations.

Doty teaches that all ambient and power-driven temperature cycle fluctuations can be modeled generically for each application in four phases (Doty: Slide 3). Doty proceeds to give requirements for accelerated life tests for various lifetimes & environments (Doty: Slide 5) and stress conditions (Doty: Slide 6).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to combine the teachings of Doty and Mencinger to create a model for ambient and power-driven temperature cycle fluctuations for various situations. The motivation would have been that Doty's discloses the requirements/parameters for accelerated life test for various ambient and power driven fluctuation situations (Doty: Slides 5 &6) and Mencinger teaches that a package/processor lifetime can be broken down into different types of fluctuations from the point it manufactured till the end of the package/processor lifetime. Further, Mencinger cites Doty's and others teachings as references in his paper.

<u>Regarding Claim 2</u>

Mencinger teaches different types of ambient and power-driven temperature cycles as storage cycles (Mencinger: Page 2, Col. 2, Line 1; Table 1), on/idle operation cycles as expected Duty cycle (Mencinger: Page 2, Col. 1, Line 51; Table 1), power on/off (Mencinger: Page 2, Col. 1, Line 51; Table 1), application use cycles within and between program use as suspend/resume cycles (Mencinger: Page 2, Table 1),

and product transfer cycles (Mencinger: Page 3, Col. 2, Line 14-19) and shipping cycles for temperature fluctuations (Mencinger: Page 4, Table 2, 3rd Row).

Regarding Claim 3

Mencinger teaches that test requirements depend upon market application use of package/chip device and further goes on to list 3 exemplary market/applications (Mencinger: Page 4, Table 2, 1st Row). Doty also teaches that there are various markets/applications that have different environments (Doty: Slide 2).

Regarding Claim 4

Mencinger teaches through example how accelerated life test parameters used to assess reliability of a package/chip to expected frequencies and magnitudes of temperature cycle fluctuation encountered can be modeled. He uses Flip-Chip application environment (Mencinger: Page 4, Failure Mechanism Modeling). He also teaches that model used is the baseline model from white papers by Both Sematech's RTAB and Intel. The application defined in this case is flip-chip package going through thermal cycling. The quantifying expected frequency (Mencinger: Page 4, Failure Mechanism Modeling - 1500 cycles) and magnitude (Mencinger: Page 4, Failure Mechanism Modeling – delta-T = 40 degree centigrade) is provided fir the end user environment temperature regime. Coffin-Manson accelerated life model is used by Mencinger to incorporate the end user environment temperature regime (Mencinger: Page 5, Col.1, Lines 1-6; Table 3) exemplified. The incorporation together with Delta-T vs. Accelerated Cycle counts and acceleration mechanism component yields the number-of-cycles-require to stress test with the

model (Mencinger: Page 5, Col.2, Figure 3). Hence Mencinger directly teaches all the limitations of this claim.

Mencinger does not teach plurality of temperature cycle fluctuation regimes, instead gives an exemplary regime showing all the limitation of the claim.

Doty teaches plurality of temperature cycle fluctuation regimes for the operation life cycle of the package/chip as power up/down (0-50 degree C, 10 time a day), ambient temperature excursions per day (0-40 degree C, 2 times a day) and associated accelerated lifecycles with such fluctuation regimes (Doty: Slide 2, Col.1, Operational Life, Col.2. Stress Condition).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to combine the teachings of Doty and Mencinger to create a model for ambient and power-driven temperature cycle fluctuations for various situations. The motivation would have been that Doty's discloses the requirements/parameters for accelerated life test for various ambient and power driven fluctuation situations (Doty: Slides 5 &6) and Mencinger teaches that a package/processor lifetime can be broken down into different types of fluctuations from the point it manufactured till the end of the package/processor lifetime. Further, Mencinger cites Doty's and others teachings as references in his paper.

Regarding Claim 5

Mencinger teaches different types of ambient and power-driven temperature cycles as storage cycles (Mencinger: Page 2, Col. 2, Line 1; Table 1), on/idle operation cycles as expected Duty cycle (Mencinger: Page 2, Col. 1, Line 51; Table 1), power on/off (Mencinger: Page 2, Col. 1, Line 51; Table 1), application use cycles within and between program use as suspend/resume cycles (Mencinger: Page 2, Table 1), and product transfer cycles (Mencinger: Page 3, Col. 2, Line 14-19) and shipping cycles for temperature fluctuations (Mencinger: Page 4, Table 2, 3rd Row).

Regarding Claim 16

Method claim 16 is directed towards the same limitations as the method claims 4 & 5 and is rejected for the same reason as claims 4 & 5.

2. Claims 6-12, 14, 17-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Intel Technology Journal Q3, 2000" by Nicholas P. Mencinger et al (Mencinger hereafter) in view of "Application Specific Package Qualification Specification – Overview of the Project" by Matt Doty, Amkor (December 1999) (Doty hereafter) and further in view of "ReliaSoft's ALTA 1.0 On Site Training Guide – 1999" by ReliaSoft Corporation (ALTA 1.0 Hereafter).

Regarding Claim 6

Mencinger & Doty teach limitation related to collecting user, application and environment data as disclosed in claims 4 & 5 from which claim 6 depend.

Mencinger & Doty do not teach providing a program interface to enter user specified parameters.

ALTA 1.0 teaches a software interface to provide reliability and failure analysis based temperature, humidity and voltage (ALTA 1.0: Page 4, Lines 2-3). ALTA 1.0 teaches program interface to enter user/environment inputs such as temperature (ALTA 1.0: Page 8, 1st Figure), warranty life(ALTA 1.0: Page 21, Method 2, Step 3; Page 22; 1st Figure showing Mission End Time as warranty life). Further, ALTA 1.0 teaches that subroutines based on user selection & model selected calculates the parameters (ALTA 1.0: Page 10, Lines 5-9) and then displays them to the end user (ALTA 1.0: Page 10, 1st Figure).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to combine the teachings of Mencinger & Doty with ALTA 1.0 software interface to create a software which would determine power

(proportional to voltage) and temperature fluctuation based reliability & failure estimation based on the Coffin Manson empirical formula. The motivation would have been that ALTA 1.0 teaches automated reliability calculation based on Inverse Power Law Model (ALTA 1.0: Page 15, 2nd Figure: Stress Life Relationship) and Coffin Manson empirical formula taught by Mencinger is also inverse power law model. ALTA 1.0 teaches automation with a various models and Mencinger teaches a slightly modified model, whose automation can very useful. Further, ALTA 1.0 teaches means of generating data & parameters using Monte Carlo Simulation Tool (ALTA 1.0: Page 4, 1st Figure: Button Icons 1st Row, 11th button; Page 58) from user input and Mencinger discloses use of such data to calculate the cycles-to-fail parameter based on Coffin Manson empirical formula (Mencinger: Page 5, Col.2, Figure 3).

Regarding Claim 7

Mencinger, Doty & ALTA 1.0's teachings are presented in claim 6 and its parent claims.

ALTA 1.0 does not teach separate routines for consumer application and environmental informational gathering. However along with Mencinger & Doty it presents functional equivalence to subroutines for collection of user data and application of such data to generate consumer behavior information like temperature fluctuation (ALTA 1.0: Page 4, 1st Figure: Button Icons 1st Row), lifetime model (Mencinger: Page 3, Figure 2), to generate application workload information (Doty:

Page 7, Table 2) and to generate environmental conditions temperature fluctuations based on OEM input (Mencinger: Page 4, Table 2).

Regarding Claim 8

Mencinger teaches through exemplary calculations for estimating ambient temperature fluctuation frequencies for a temperature cycles regime (Mencinger: Page 4, Table 2; Page 5, Col.1, Lines 1-6; Table 3) based on user input and parameters calculated. Such calculations can be repeated for other temperature regimes for lifetime of a product based on other temperature regime data from other sources. Mencinger (Mencinger: Page 4, Col.1, Table 2, Row 4) & Doty (Doty: Page 7, Table 2: Duty Cycle) also talks about power driven temperature fluctuation for a temperature regime.

Regarding Claim 9

Doty teaches calculation of temperature profile from ambient, board, environment & junction fluctuation frequencies (Doty: Page 18, Figures 5 & 6). The temperature profiles include probability density function (*pdf*) for temperature fluctuation regime (Doty: Page 12, Section 5.8 Model for wear out failure. ALTA 1.0 also teaches variation of *pdf* with different stress factors (temperature, time) (ALTA 1.0: Page 38-42, 3.4.2 Example 7).

Regarding Claim 10

Doty teaches various temperature profiles to include rate of temperature change, dwell time, ramp times (Doty: Slide 6, Rows 2-3) for thermal shock and temperature cycling.

Regarding Claim 11

Mencinger teaches inputting user input, temperature fluctuations frequencies and temperature profiles into accelerated life model (Coffin Manson) to calculate the number of accelerated test cycles required (Mencinger: Page 5, Col.1, Lines 1-6; Figure 3). Mencinger does not explicitly teach how to calculate the number of on/off power cycles required to simulate the on/off power fluctuations, but provides all the inputs for different applications (Mencinger: Page 4, Table 2), the formula (Mencinger: Page5, Table 3) and the method (Mencinger: Page 5, Col.1, Lines 1-6; Figure 3) to calculate it. Mencinger selects a power law coefficient to select a particular modeling stress. Doty also teaches the process of incorporating the temperature fluctuations frequencies into Coffin-Manson empirical formula (Doty: Page 11, Section 5.6.8).

Regarding Claim 12

ALTA 1.0 teaches how the temperature profiles and *pdf* of the number of accelerated test cycles required can be outputted in tabular and graphical form (ALTA 1.0: Page 27: Section 2.6.2 – Shows Lifetime Vs Stress pdf; Page 40, 2nd Plot – Shows pdf Vs time (test cycles)). ALTA 1.0 does not show the same for on/off power cycle but sets precedence as to how the method and display should look like. ALTA 1.0 teaches the relationship between *pdf*, confidence level & number of test cycles and how to visualize it (ALTA 1.0: Page 23-27, Example 3; Page 37-42, Example 6).

Regarding Claim 14

Mencinger teaches the Coffin Manson model for thermo-mechanical methodology (Mencinger: Table 3). Mencinger also teaches the various ambient and usage power driven temperature cycle fluctuation regimes (Mencinger: {Page 2, Table 1 – Use Conditions; Page 3, Col.2, Lines 14-19; Page 4, Table 2 – thermal and ambient fluctuations).

Mencinger does not teach modified Coffin Manson model explicitly in form of a formula as disclosed in the specification.

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the Coffin Manson model as described by Mencinger to apply to the various temperature regimes, also described by Mencinger. The motivation would be that Mencinger lays out the modified formula by giving the breakdown in form of various temperature regimes except explicitly listing it as in the instant application. Hence, the next step and obvious step would have been to put in the form of the modified formula. There is no innovative step in this method claim.

Regarding Claim 17

Method claim 17 is directed towards the same limitations as the method claims 6 & 7 and is rejected for the same reason as claims 6 & 7.

Regarding Claim 18

Mencinger teaches warranty life as lifetime expectation and further categorizes them as OEM and user lifetime expectation (Mencinger: Page 2, Col.2, Lines 29-32)

based on survey (Mencinger: Page 3, Col.1, Lines 15-16). Teachings about calculating a temperature profile and further limitations are rejected for the same reason as claim 9.

Regarding Claims 19 & 20

Apparatus claims 19 & 20 are directed towards the same limitations as the method claims 4,5 & 6 and are rejected for the same reason as claims 4, 5 & 6. Claim 6 also discloses an interface, which ALTA1.0 teaches in sufficient detail to address program interface, computer-readable and executable limitations of this claim.

Regarding Claim 21

Apparatus claim 21 is directed towards the same limitations as the method claim 5 and is rejected for the same reason as claim 5.

Regarding Claim 22

Apparatus claim 21 is directed towards the same limitations as the method claims 8 & 9 and is rejected for the same reason as claims 8 & 9.

3. **Claims 13 & 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Intel Technology Journal Q3, 2000" by Nicholas P. Mencinger et al (Mencinger hereafter) in view of "Application Specific Package Qualification Specification – Overview of the Project" by Matt Doty, Amkor (December 1999) (Doty hereafter) and further in view of "ReliaSoft's ALTA 1.0 On Site Training Guide – 1999" by ReliaSoft Corporation (ALTA 1.0 Hereafter), further in view of "Semiconductor device reliability Failure Models" by Ted Dellin et al (Dellin hereafter), Sematech International.**

Regarding Claim 13

Mencinger, Doty & ALTA 1.0's teachings are presented in claim 11 and its parent claims. Mencinger, Doty & ALTA 1.0's do not teach explicitly a modified Coffin Manson empirical formula/model.

Dellin teaches a modified Coffin Manson empirical formula for various temperature regimes that include creep and plasticity effects (Dellin: Page 19, Section G; Modified Coffin-Manson Model).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the Coffin Manson model as described Dellin and use it with teachings of Mencinger, Doty & ALTA 1.0 to make it more functionally useful. The motivation comes from Mencinger, as refers to industry accepted stress models to come from paper by Dellin (Sematech International) (Mencinger: Page 2, Col.2, Lines 21-25; Page 4, Col.2, Lines 13-18).

Regarding Claim 15

Dellin also teaches temperature fluctuation ratio includes a material property factor for temperature creep and plasticity (Co) (Dellin: Page 19, Section G; Modified Coffin-Manson Model; Page 20, Lines 1-8).

(10) Response to Argument

A. Regarding Claims 1-4

Appellant has argued the following against Mencinger:

> In contrast to claims 1 and 4, Mencinger refers to a mechanism-based methodology for processor package assessments, in which failure mechanisms are modeled with the appropriate physical model. In this regard, Mencinger does not disclose, or even suggest, determining accelerated life test requirements that represent ***each*** of a plurality of different types of temperature cycles fluctuations a package/device is expected to undergo ***over the product lifetime***, as recited by claim 1, or incorporating into the accelerated life model quantified expected frequencies and magnitudes of temperature fluctuations of a package/chip device in each of a plurality of temperature regimes over the product lifetime, as recited by claim 4. Indeed, the Office Action admits on pages 6 and 8 that Mencinger does not teach a plurality of temperature cycle fluctuation regimes nor accelerated life test requirements for all situations. Accordingly, Mencinger fails to disclose, or even suggest, the features of claims 1 and 4 with respect to determining the accelerated life test requirements that represent each of the plurality of different types of temperature cycles fluctuations a package/device is expected to undergo over a product lifetime, or incorporating into an accelerated life model quantified expected frequencies and magnitudes of temperature fluctuations of the package/chip device in each of the plurality of temperature regimes over the product lifetime.

Examiner respectfully disagrees with the appellant for the following reasons, and asserts that Mencinger teaches each of a plurality of different types of temperature cycles fluctuations a package/device in each of the plurality of temperature regimes over the product lifetime.

First, appellant is claiming, "***each*** of a plurality of different types of temperature cycles fluctuations", however no specific different types of temperature cycles are claimed. Appellant has however pointed to specification Pg. 10 Lines 14- Pg. 12 Line 4, Fig. 4 that has more details than the scope of the claim. Claims 1 & 4 are indefinite for failing to particularly point out and distinctly claim the subject matter which appellant regards as the invention, namely what each constitute.

Secondly, arguendo, even if "***each*** of a plurality of different types of temperature cycles fluctuations", is read as disclosed in the specification (Pg. 10 Lines 14- Pg. 12 Line 4,

Fig. 4) having ***(a)*** storage, ***(b)*** transportation and ***(c)*** utilization in various market segments based temperature fluctuation, it is still adequately addressed by Mencinger (Mencinger: Page 4, Table 2). Claim 1 is updated to map rejection to specification and repeated below:

Mencinger teaches determining accelerated life tests requirements (Mencinger: Page 4, Table 2) for one example – each type of temperature cycles fluctuations specified as – ***(a)*** accelerated test during ***storage cycles*** (Mencinger: Page 4, Table 2 – Maximum and Minimum sustained storage temperatures of 45 degree C up to 1 year/ -10 degree C up to 1 year); ***(b)*** temperature fluctuations during ***shipping cycles*** (Mencinger: Page 4, Table 2 - as short duration extreme ambient temperature exposure during shipping and transportation (-)45 degree C to (+)75 degree C up to 24 hours); ***(c), power/temperature*** fluctuations due to ***idle/on for various models/market segment*** (Mencinger: Page 4, Table 2 – slow thermal cycles due to power supply variations for notebook(NB – 300 cycles), desktop (DT) and workstation (WS – 1500 cycles) market segments; fast processor on/off cycles – WS 3500 cycles, DT/NB – 7500 cycles). <u>Therefore teaching each of different types of temperature cycle fluctuations.</u>

Thirdly, as broadly claimed, Mencinger teaches other temperature cycles other than one disclosed, e.g. accelerated test during surface mounting, socketing and manufacturing.

Appellant has argued the following against Doty:

> Also in contrast to claims 1 and 4, Doty refers to a strategy for implementation of application specific characterization/qualification involving four application phases. See Slides 1 to 3. In this regard, Doty does not disclose, or even suggest, determining accelerated life test requirements that represent **each of a plurality of different types of temperature cycle fluctuations a package/device is expected to undergo over a product lifetime**, or incorporating into an accelerated life model quantified expected frequencies and magnitudes of temperature fluctuations of a package/chip device in each of a plurality of temperature regimes over the product lifetime. Instead, Doty simply refers to an application-specific semiconductor qualification methodology, in which certain stress conditions are provided that refer to temperature cycle fluctuations for <u>**only one application phase, namely, the operation phase**</u>, but not in each of the four application phases. <u>**See Slide 3, which refers to a temperature range and a number of cycles for the "Package Temp Cycle", "Interconnect Temp Cycle" and "Power Cycle" only for the operation life phase of the package/chip.**</u> In this regard, it is respectfully submitted that Doty does not consider temperature or power cycle fluctuations of other non-operational phases referred to on Slide 3, in particular, "Assembly" and "Storage/Transportation", which would presumably also occur over a product lifetime.

Examiner respectfully disagrees with appellant that Doty does not consider temperature or power cycle fluctuations of other non-operational phases referred to on Slide 3, in particular, "Assembly" and "Storage/Transportation", which would presumably also occur over a product lifetime. Slide 3 is included below on next page.

Firstly, Doty also like Mencinger teaches each of plurality of different types of temperature cycle fluctuations a package/device is expected to undergo over a product lifetime, namely ***(a)*** accelerated test during ***storage cycles*** (Doty: Slide 3, "Storage/Transportation" in Column One - factors 150 degree C for 40 Hours); ***(b)*** temperature fluctuations during ***shipping cycles*** (Doty: Slide 3, second "Storage/Transportation" in Column One - factors 150 degree C for 200 Hours with vibration); ***(c), power/temperature*** fluctuations due to ***idle/on for various models/market segment*** (Doty: Slide 3, "Operational Life" in Column One – Please

see slide 3 attached for various stress conditions and durations). <u>Therefore teaching each of different types of temperature cycle fluctuations.</u>

Amkor/Anam

Application Specific Qual

Four Phases Per Application

Storage/Transportation Air Temp: 70°C Max Humidity: 80% R.H. Max Storage Life: 1 year	**Stress Condition** High Temp Storage: 150°C	**Stress Duration** **HTS: 40 hours**
Assembly Air Temp: 40°C Max Humidity: 80% R.H. Max Floor life: infinite Peak Reflow Temp: 240°C	**Stress Condition** Preconditioning: Level 1 85oC/85%RH - 168hrs Peak Reflow Temp: 240°C	**Stress Duration** **Complete Test**
Storage/Transportation Air Temp: 70°C Max Humidity: 80% R.H. Max Storage Life: 5 years	**Stress Condition** High Temp Storage: 150°C Vibration/Shock	**Stress Duration** **HTS: 200 hours** **?????**
Operational Life Air Temp: 40°C Max Humidity: 55% R.H. Max Die Temp: 125°C Max Power up/down per day: 10 Temp range: 0°C to 50°C # Temp excursions/day: 2 Operating time/day: 12 hours Useful Life: 5 years	**Stress Condition** High Temp Op Life: 125°C Package Temp Cycle: -55°C/125°C Interconnect Temp Cycle: 0°C/100°C Temp/Humidity Bias: 130°C/85%RH Power Cycle: 20°C/125°C	**Stress Duration** **HTOL: 1500 hours** **P-T/C: 250 cycles** **I-T/C: 800 cycles** **THB: 50 hours** **PC: 3500 cycles**

Reliability and Product Analysis
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Here as alleged by the appellant, this slide does not represent only one phase – the operation phase as alleged. Column one of the slide represents different types of temperature cycle fluctuations a package/device is expected to undergo over a product lifetime, hence at least 4 such different types of temperature cycle fluctuations (namely "storage" – Doty: Slide 3 Col.1 Major row 1 & 3, "assembly" - Doty: Slide 3 Col.1 Major row 2; "Transportation" - Doty: Slide 3 Col.1 Major row 1 & 3 and "Operation" - Doty: Slide 3 Col.1 Major row 4), are shown above. The second

column in the slide shows test conditions and column three details on the <u>duration</u> of the test conditions for each of the types of temperature cycle fluctuations or specific tests. <u>Therefore teaching each of different types of temperature cycle fluctuations.</u>

Further Appellant has argued that:

> As explained above, the ***combination of Mencinger and Doty does not disclose***, or even suggest, all of the features of claim 1 or claim 4, in particular, with respect to determining the accelerated life test requirements that represent each of the plurality of different types of temperature cycles fluctuations a package/device is expected to undergo over a product lifetime, or incorporating into an accelerated life model quantified expected frequencies and magnitudes of temperature fluctuations of the package/chip device in each of a plurality of temperature regimes over the product lifetime.

Examiner has mapped all the argued features in both the prior art references Mencinger and Doty. All the claimed features are also mapped in the claim rejections to their broadest possible reasonable interpretations. No reasons or factual evidence has been presented other than attacking the prior art piecemeal wise. Appellant's allegations have not been found to be persuasive.

Further appellant is arguing speculative and hindsight reconstruction in combining Mencinger with Doty.

Mencinger cites HDP User group (Doty's teaching) in the References section and states that this parallel study was more detailed than Mencinger teaching (Mencinger: References; Pg.2 Col.1 ¶1). Hence the combination of Mencinger with Doty is not speculative reasoning. Complete analysis was performed base done on the three sources for motivation to combine in the Final Action, which is repeated below for brevity. Examiner disagrees with appellant's statement that no showing was made for in office actions or advisory action today and asserts that examiner has established a prima facie case for obviousness.

Rational for combining Mencinger and Doty (as presented in Final Office Action):

The examiner contends that the motivation to combine **Mencinger** and **Doty** is proper and in accordance with MPEP guidelines for the following reasons. MPEP 2143.01 Suggestion or Motivation To Modify the References first recites:

> "There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998)

In this case the examiners rejection first addresses the nature of the problem to be solved, namely, modeling user environments and physical models that link environment to the accelerated life test for a processor package or a chip, relative to the teachings in the prior art. The examiner references the prior art (Mencinger), which discloses environment variables, stress tests (models) for various use conditions (for various markets: Pg.2 Methodology ¶2; Table 1) and suggests improvements by using models for these (by providing conservative predetermined model acceleration coefficient). Other prior art cited by the examiner such as Doty similarly discusses these model co-efficients and various stress tests models (Doty: Section 5 requirements) for plural use conditions and market application. Here, the examiner has established that both Doty and Mencinger are solving the same nature of the problem as would be easily recognized by a person skilled in the art. Therefore, in suggesting a motivation to combine, the examiner specifically focused his motivation on the knowledge of persons of ordinary skill in the art & nature of problem to be solved. More specifically, that a skilled artisan would have made an

effort to become aware of what capabilities had been developed in the market place, and hence would have knowingly modified Mencinger with the teachings of Doty. (See: office action page 8 - motivation) MPEP 2144 Sources of Rationale Supporting a Rejection Under 35 U.S.C. 103 recites:

> "The rationale to modify or combine the prior art does not have to be expressly stated in the prior art; the rationale may be expressly or impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art, established scientific principles, or legal precedent established by prior case law. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). See also In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) (setting forth test for implicit teachings); In re Eli Lilly & Co., 902 F.2d 943, 14 USPQ2d 1741 (Fed. Cir. 1990) (discussion of reliance on legal precedent); In re Nilssen, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988) (references do not have to explicitly suggest combining teachings)"

The examiner has simply asserted that a skilled artisan tasked with solving the problem of modeling plurality of use conditions relative to temperature fluctuations in various market segments (i.e. as taught by Mencinger), from various specific conditions (use in various specific market segments; Doty: Section 5.5) and phases (manufacturing, assembly, transport and use) (i.e. as taught by Doty), and further having access to the teachings of Mencinger and Doty, would have knowingly modified the teachings of Mencinger, with the teachings of Doty in order to gain the advantage of certifying the reliability of a processor package by using varied, conservative, comprehensive models for different environmental conditions (including various temperature fluctuation magnitude & frequencies). Specifically, a skilled artisan working in this obviously competitive environment would have made an effort to become aware of what capabilities had already been developed in the market place, and hence would have been aware of, and known to seek out the relative teachings of the problem to be solved.

Further, Mencinger implicitly recites the using Doty (Mencinger: reference [4], Pg .2 Lines 8-10) and provides a rationale to combine the two disclosed prior arts.

MPEP 2143.01 Suggestion or Motivation To Modify the References further recites the following supporting rational:

> Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. **"The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art."** In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000).

The examiner therefore appears to have established an implicit showing that in view of the combined teachings of the prior art, the relative knowledge of one skilled in the art, and in particular, the nature of the problem to be solved, there exists an obvious motivation to combine the references as noted above.

In response to appellant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the appellant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). Examiner has previous established implicit showing that Mencinger and Doty are combinable.

Regarding Claims 16

Appellant has argued the following:

> Claim 16 recites features essentially analogous to claim 4, and is therefore allowable for at least the same reasons as claim 4. Moreover, claim 16 further recites quantifying frequencies and magnitudes of temperature fluctuations based in part on the ***shipping route taken by the product***, which is neither disclosed nor suggested by Mencinger and/or Doty. The Office Action asserts that because <u>Appendix A of the Doty reference refers to seasonal variation of the temperature</u> it would be obvious to one skilled in the art at the time the invention was made to model similar temperature relationships based on shipping routes. However, such relationships are clearly not similar, since, for example, the seasonal temperature variations referred to by Doty involve an overall trending of the temperature data occurring over a long period time, rather than an immediate impact as would be expected by the product taking a different shipping route. Hence, the seasonal temperature variation is used by Doty to create a year-long baseline temperature onto which the daily fluctuations are superimposed, rather than quantifying the frequencies and magnitudes of temperature fluctuations pertinent to each identified ambient and power driven temperature fluctuation, as required by claim 16.

Examiner respectfully disagrees that the combination of Doty and Mencinger do not teach temperature fluctuations based in part on the ***shipping route taken by the product***. Doty teaches the seasonal fluctuation based on the shipping routes taken. Appellant has alleged that this is based on data occurring over a long period time, rather than the product taking a different shipping route. There is no indication in Doty that the impact is short termed (immediate) or long term (long period of time), hence the teaching of Doty encompasses both.

Even if, arguendo, the impact of the temperature is immediate based (short termed as compared to seasonal) during a shipping route, such teaching is presented by Mencinger (Mencinger: Table 2: Row 2 showing short duration extreme ambient temperature exposures during shipping and transportation). Appellant has neither claimed plurality of shipping routes nor does the Fig.2 shows plurality of shipping routes and how they vary in temperature. Further for the argument sake, even if there were multiple entries for shipping route 82, in Fig.2, such plurality of entries

would be obvious to one skilled as it would require changing the range and duration numbers for Mencinger (Mencinger: Table 2: Row 2 showing short duration extreme ambient temperature exposures during shipping and transportation – (-)45 to (+)75 for up to 24 hours). Appellant has already acknowledged above such statistical collection of data is known in the art.

> "Hence, the seasonal temperature variation is used by Doty to create a year-long baseline temperature onto which the daily fluctuations are superimposed..."

Therefore examiner asserts that variations in shipping route taught by Mencinger Doty combination.

B. Regarding Claims 6-12, 14 and 17-22

Appellant is arguing the following:

> Further, it is respectfully submitted that the **Mencinger and Doty references are not properly combinable with the ReliaSoft reference** since there exists no express motivation in any of the references to combine them. In this regard, the Office's assertion that "[t]he motivation would have been that [ReliaSofl] teaches automated reliability calculation based on Inverse Power Law Model ([ReliaSoft]: Page 15, 2nd Figure: Stress Life Relationship) and Coffin Manson empirical formula taught by Mencinger is also inverse power law model" is a mere speculative suggestion on the part of the Examiner, which fails to demonstrate a requisite motivation to modify the Mencinger reference to provide the claimed features, which the Office admits is not disclosed by Mencinger. Indeed, such an assertion does not explain ***why*** a person skilled in the art would be motivated to modify the Mencinger reference. Moreover, the assertion by the Office that the Coffin Manson empirical model is a mere equivalent of any Inverse Power Law model is a drastic over simplification of the technical subject matter described.

Examiner would first like to site the complete motivation to combine which appellant does not seem to have considered.

> It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to combine the teachings of Mencinger & Doty with ALTA 1.0 software interface to create a software which would determine power (proportional to voltage) and temperature fluctuation based reliability & failure estimation based on the Coffin Manson empirical formula. The motivation would have been that ALTA 1.0 teaches automated reliability calculation based on Inverse Power Law Model (ALTA 1.0: Page 15, 2nd Figure: Stress Life Relationship) and Coffin Manson empirical formula taught by Mencinger is also inverse power law model. ALTA 1.0 teaches automation with a various models and Mencinger teaches a slightly modified model, whose automation can very useful. Further, ALTA 1.0 teaches means of generating data & parameters using Monte Carlo Simulation Tool (ALTA 1.0: Page 4, 1st Figure: Button Icons 1st Row, 11th button; Page 58) from user input and Mencinger discloses use of such data to calculate the cycles-to-fail parameter based on Coffin Manson empirical formula (Mencinger: Page 5, Col.2, Figure 3).

It can be clearly seen that ALTA 1.0 (or ReliaSoft) complements the Mencinger in various steps and is performing a very similar analysis (temperature based stress analysis), as Mencinger is disclosing the methodology and ALTA 1.0 is providing the means to implement the methodology using the concept (Inverse Power Law Model & Coffin Manson empirical formula) taught by Mencinger. To <u>make and use</u> Mencinger's invention one skilled in the art would have resorted to some software programming means, which ALTA 1.0 provides. ALTA 1.0 teaches temperature

based stress analysis software tool (ALTA 1.0: Section 2.2) which is required to implement teachings of Mencinger and Doty. Comment regarding the inverse square law is considered and was not mere speculative assertion. Examiner was attempting to exactly point to how the teachings of ALTA 1.0 were generic enough to encompass the methodology of Mencinger and specific enough to be programmed by skilled in the art to be implemented in ALTA1.0.

MPEP 2143.01 Suggestion or Motivation To Modify the References first recites:

> "There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998)

In this case the examiners rejection first addresses the nature of the problem to be solved, namely, modeling user environments and physical models that link environment to the accelerated life test for a processor package or a chip, relative to the teachings in the prior art ***using a software tool and formulas relevant to the such modeling environment*** (Inverse Power Law Model & Coffin Manson empirical formula). The examiner references the prior art (Mencinger), which discloses environment variables, stress tests (models) for various use conditions (for various markets: Pg.2 Methodology ¶2; Table 1; Also see Pg.2 Col.1 ¶1) and suggests improvements by using models for these (by providing conservative predetermined model acceleration coefficient). Other prior art cited by the examiner such as Doty similarly discusses these model co-efficients and various stress tests models (Doty: Section 5 requirements) for plural use conditions and market application. ALTA 1.0 complements the conceptual teaching of Mencinger and Doty by providing a

software programming interface to solve temperature based stress analysis (ALTA 1.0: Section 2.2). Here, the examiner has established that both ALTA 1.0 with Doty and Mencinger are solving the same nature of the problem as would be easily recognized by a person skilled in the art. Therefore, in suggesting a motivation to combine, the examiner specifically focused his motivation on the knowledge of persons of ordinary skill in the art & nature of problem to be solved. More specifically, that a skilled artisan would have made an effort to become aware of what capabilities had been developed in the market place (ALTA 1.0), and hence would have knowingly modified Mencinger-Doty (See: office action page 8 - motivation) with ALTA 1.0.

MPEP 2144 Sources of Rationale Supporting a Rejection Under 35 U.S.C. 103 recites:

> "The rationale to modify or combine the prior art does not have to be expressly stated in the prior art; the rationale may be expressly or impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art, established scientific principles, or legal precedent established by prior case law. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). See also In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) (setting forth test for implicit teachings); In re Eli Lilly & Co., 902 F.2d 943, 14 USPQ2d 1741 (Fed. Cir. 1990) (discussion of reliance on legal precedent); In re Nilssen, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988) (references do not have to explicitly suggest combining teachings)"

Examiner finds appellant's arguments unpersuasive.

C. Regarding Claim 13 and 15

Appellant has argued the following:

> "Moreover, the assertion by the Office that "[i]t would have been obvious to one (e.g., a designer) of ordinary skill in the art at the time the invention was made to take the Coffin Manson model as described in Dellin and use it with the teachings of Mencinger, Doty and [ReliaSott] to make it more functionally useful" (emphasis added) is mere hindsight reasoning and fails to demonstrate a requisite motivation to modify the Mencinger reference to provide the claimed features, which the Office admits is not disclosed by Mencinger."

Examiner would first like to site the complete motivation to combine which appellant does not seem to have considered.

> It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the Coffin Manson model as described Dellin and use it with teachings of Mencinger, Doty & ALTA 1.0 to make it more functionally useful. ***The motivation comes from Mencinger, as it refers to industry accepted stress models to come from paper by Dellin (Sematech International) (Mencinger: Page 2, Col.2, Lines 21-25; Page 4, Col.2, Lines 13-18).***

Teachings of Mencinger clearly reference and use the teachings of Dellin. Further, Dellin is further analogous art (See title/abstract of Dellin: "Semiconductor device reliability Failure Models") to Mencinger (See title/abstract of Mencinger: "A mechanism-based Methodology for Processor Package Reliability Assessments") where Mencinger teaches Coffin Manson empirical formula (Mencinger: Pg. 4 Section "Failure Mechanism Modeling") and Dellin teaches the modified Coffin Manson empirical formula for various temperature regimes (Dellin: Page 19, Section G; Modified Coffin-Manson Model) to include other advanced factors like creep and plasticity for better modeling. Examiner has shown nature of problem to be solved is common to both Dellin and Mencinger, including the state of the prior art where, Dellin clearly teaches more precise Coffin-Manson empirical model and Mencinger is aware of such a model. Examiner finds appellants arguments unpersuasive.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Akash Saxena

Akash Saxena
Patent Examiner, GAU 2128
(571) 272-8351
Monday, April 09, 2007

Conferees:

Kamini S. Shah
Supervisory Patent Examiner, GAU 2128
Structural Design, Modeling, Simulation and Emulation

Eddie C. Lee
Supervisory Patent Examiner, TC 2100,
(571) 272-1732

EDDIE C. LEE
SUPERVISORY PATENT EXAMINER